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WASHINGTON, D.C.

AIR TRAFFIC CONTROL FACTUAL REPORT

By: R. J. Wentworth
(22 pages)

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D. C. 20594

February 19, 1998

AIR TRAFFIC CONTROL GROUP CHAIRMAN'S

FACTUAL REPORT OF INVESTIGATION

A. ACCIDENT

1. Airplane: Korean Air Flight 801, a Boeing 747-300, HL-7468
2. Date: August 6, 1997
3. Location: Nimitz Hill, Guam
4. Time: 0142 local (1542 UTC)[1]
5. NTSB No: DCA-97-MA-058

B. AIR TRAFFIC CONTROL GROUP

Richard J. Wentworth, Chairman	NTSB, AS-30, Washington, D. C.
Charles R. Mote, Jr., Member	NATCA Air Traffic Controller Tucson, Arizona
Captain G. S. Yim, Member	Korean Air Seoul, Korea

[1] All times will be in local time based on the 24-hour clock with the exception of those times expressed in the, "History of Flight" which will be expressed in Universal Coordinated Time (UTC) or unless otherwise indicated.

Mr. Hyang-Gyu Park, Member	Civil Aviation Bureau Deputy Director Flight Operations and ATS Division Seoul, Korea
David Power	FAA Airways Systems Specialist Guam SCC

C. SUMMARY

On August 6, 1997, at approximately 0142 Guam Local Time, a Boeing B-747-300 (3B5B) operated by Korean Air Co. Ltd. as Korean Air flight 801 en route from Seoul, Korea (RKSS) to Guam, crashed while on approach to runway 6L at the A. B. Won Pat Guam International Airport, Agana, Guam (PGUM).

At the time of the accident, the glide slope associated with the instrument landing system (ILS) to runway 6L was out of service; however, the localizer was operational. During the approach, the airplane contacted high terrain about 3.5 nautical miles southwest of the airport.

The 0132 reported weather at Guam International Airport was: wind from 090 degrees at 6 knots; visibility was 7 statute miles with showers vicinity and there was a scattered layer of clouds at 1,600 feet, a broken layer at 2,500 feet and an overcast layer at 5,000 feet[2].

The flight was operated as a scheduled 14 Code of Federal Regulations (CFR) Part 129 passenger service flight. The crew consisted of two pilots, one flight engineer, one purser, thirteen flight attendants and 231 passengers. Also, there were six deadheading flight attendants aboard the flight.

Of the 254 occupants on board, 225 were fatally injured and 25 passengers and 4 flight attendants survived the accident with minor to serious injuries. However, during the 30 days following the accident, two passengers and one deadheading flight attendant succumbed to their injuries. The airplane was destroyed by impact and fire.

D. DETAILS OF THE INVESTIGATION

1. History of Flight

.At 1503:21, the flightcrew made initial radio contact with the R-4 radar controller at the Guam Combined Center/RAPCON[3] (CERAP) stating, "Guam Center Korean eight zero one maintain level four one zero approaching MIXSS[4]". The radar controller, responded,

[2] See Meteorologists Group Chairman's Factual Report
[3] RAPCON - radar approach control
[4] MIXSS is a navigational fix located about 200 nautical miles northwest of Guam.

"annyunghaseyo[5] Korean eight zero Guam Center proceed direct to Nimitz squawk two three three seven". The flightcrew acknowledged the instruction. At 1505:42, the radar controller transmitted, "Korean eight zero one radar contact two zero miles southeast MIXSS expect runway six left. At 1510:54, the radar controller instructed, "Korean air eight zero one descend at your discretion maintain two thousand six hundred". The flightcrew acknowledged this instruction. On the morning of August 6, 1997, there were 2 full performance level (FPL) controllers who were assigned to the midnight shift. A review of FAA Form 7230-4, "Position Log" indicates that at 1511, the D-3 Associate Radar Position was combined at the R-4 radar position. At that time, one controller left the control room to go on break, leaving the other controller responsible for all positions of operation. At 1513:42, KAL801 advised the radar controller, "leaving four one zero for two thousand six hundred". The radar controller acknowledged their descent.

At 1522:07, the radar controller advised, "Korean eight zero one information uniform is current in Agana altimeter two nine eight six". At 1522:12, the flightcrew replied, "Korean air eight zero one is checking uniform". At 1524:30, the flightcrew transmitted, "Guam Center Korean eight zero one request deviation one zero mile left of track". The radar controller approved the request. At 1528:56, the flightcrew transmitted, "Guam Center Korean eight zero one request right turn heading one six zero". The radar controller asked them to repeat their request. At 1529:12, the flightcrew replied, "Korean eight zero six eight zero one maintain heading one six zero". The radar controller approved the request. At 1531:20, the flightcrew advised, "Guam Center Korean air eight zero one clear of charlie bravo[6] request radar vectors for runway six left". At 1531:31, the radar controller replied, "Korean air eight zero one fly heading one two zero". The flightcrew acknowledged the heading.

At 1537:56, the radar controller initiated a interphone call to the controller at the airport control tower to advise, "inbound". The tower controller responded. At 1538:04, the radar controller replied, "twelve west Korean air eight zero one seven forty seven I-L-S six left k-m[7]". The tower controller inquired, "understand seven four". The radar controller replied, "that's what I show". At 1538:09, the tower controller replied, alright thanks t-o".

At 1538:51, the radar controller transmitted, "Korean air eight zero one turn left heading zero nine zero join localizer". At 1538:54, the flightcrew replied, "roger maintain heading zero nine zero intercept the localizer". At 1539:44, the radar controller transmitted, "Korean eight zero one cleared for I-L-S runway six left approach glideslope unusable". At 1539:44, the flightcrew replied, "Korean eight zero one roger cleared for I-L-S runway six left". At 1540:45, the radar controller transmitted, "Korean air eight zero one contact Agana tower one one eight point one, annyunghy gaseyo[8]". At 1540:47, the flightcrew acknowledged the frequency change.[9]

The air traffic control tower was manned by one controller on duty who was responsible for all positions of operation in the tower cab. Upon initial contact with the tower at 1541:07[10], the flight

[5] Korean expression of hello

[6] Phonetic for CB or cumulonimbus clouds usually associated with areas of rain showers and thunderstorms

[7] Controllers are required to terminate all interphone calls with their operating initials

[8] Korean for goodbye

[9] A review of the recorded voice communications for the CERAP indicated that from 1455 to 1602, the radar controller was in communication with 8 aircraft.

[10] The times from the tower tapes could not be determined conclusively. The time code on the tape was garbled and is not accurate and it was noted that a disparity of 12 to 13 seconds existed between those times recorded by the CERAP and those of the control tower. The times of

crew advised, “Agana tower Korean air eight zero one ah (unintelligible) localizer six left”. At 1541:14, the local controller replied, “Korean air eight zero one Agana tower runway six left---wind---zero niner zero at seven cleared to land verify heavy boeing seven forty seven tonight”. At 1541:26, the flightcrew responded, “Korean eight zero one roger (unintelligible) six left”. At 1541:30, the local controller replied, “Korean eight zero one heavy roger”. From the period 1543:55 until 1544:14, a conversation ensued between the local controller and the CERAP concerning a flight plan for an aircraft that was departing Guam en route to Saipan. At 1545:25, the local controller then initiated a radio call to KAL801 and received no reply. From the period 1547:03 until 1547:27, the local controller then began an exchange of information with the ramp control regarding KAL801 in trying to determine what the assigned gate would be. At 1548:05, the local controller again called KAL801 and did not receive a reply. At 1549:51, the local controller called the ramp control to ask if they had been in radio contact with KAL801 and was told that they had not. At 1550:10, the local controller asked the controller at the CERAP if KAL801 has returned to his frequency and was told that they had not. This conversation continued until 1550:40. The local controller then called the tower controller at Anderson Air Force Base to ask if the flightcrew of KAL801 had called them. The Anderson controller told him, “…I don’t have any lights on so I don’t I don’t see anybody out there”. At 1552:04 and 1552:38, the local controller again called the flightcrew of KAL801 without receiving a reply. After a continuing dialogue with the CERAP and ramp control, at 1555:56, the local controller told ramp control, “yeah ah you might want to advise the manager”. At 1556:11, the local controller again attempted to contact KAL801 without success. The local controller then called the CERAP and at 1557:17, was told, “Ryan[11] said there’s a fire on the hillside”. At 1557:45, the local controller again called the ramp control to confirm that an accident had occurred and at 1558:13, the local controller advised the ramp control, “ok I’m going to call crash ah I’m going to ring the crash phone now”. A review of the logs for the airport crash/fire/rescue unit show that a call from the tower indicating that a B-747 was down, occurred at 0205 local time.

2. Airspace, Airport and Facilities

CERAP

Guam (Combined Center/Radar Approach Control) CERAP is classified as a Level III terminal radar facility. The facility airspace encompasses a 250 nautical mile radius centered around the Mt. Santa Rosa radar site. The facility has 3 radar positions of operation; two en route and one approach control. The en route positions use an FPS-93A long-range radar system, connected to an ATCBI-5[12]-S encoder, and digitized, narrow-band MICRO-EARTS processing system. The terminal position uses an ASR-8 radar system, connected to an ATCBI-4 encoder. This system is augmented by an ARTS-IIA analog display processor. Both the FPS-93 and ASR-8 sensors are located on Mt. Santa Rosa, about 1,500 feet apart.

In general, the CERAP airspace is comprised of concentric circles, centered around the radar antenna site. Their designated airspace is adjoined on all sides by Oakland Center oceanic sectors. The 250 nautical mile outer ring encompasses the airspace from surface to infinity is classified as Oceanic airspace. A 100 nautical mile radius inner airspace ring centered around the

interphone communications between the CERAP and the tower are derived from the time code of the CERAP.

[11] Ryan 789 who was inbound to Guam behind KAL801.

[12] ATCBI- air traffic control beacon interrogator

radar sensors, with a lateral extension over Saipan radio beacon, is domestic airspace, which extends from the surface to flight level (FL) 280. Airspace over Saipan and Guam is classified as Approach Control airspace, which extends from the surface to 17,000 feet.

The R-1 radar position encompasses the inner circle. The R-4 radar position airspace encompasses the outer circle. The arrival radar (AR) terminal position encompasses a smaller inner ring, which is an elongated 25 nautical mile radius from the Nimitz TACAN to the Anderson TACAN, and extends from the surface to 17,000 feet. There is a D-side position designated as D-3, which is associated with the R-4 radar position.

Afternoon traffic consists primarily of northbound overflights. Landing traffic is primarily inbound from Asia. In late evening, this is reversed. Authorized staffing for Guam CERAP is 14 full performance level controllers (FPL's), 3 supervisors, two staff specialists (an Automation Specialist, and a Quality Assurance/Training Specialist), and an Air Traffic Manager and secretary.

Tower

The Area 4 Federal Contract Tower contract for the air traffic control tower at Guam was awarded to Barton ATC International, Inc., during August 1994. Barton was purchased by Serco in January 1997 and at the time of the accident was in the process of changing the name on the contract with the Federal Aviation Administration. Serco has 50 years of experience providing air traffic control, weather, ground electronic systems maintenance and airport rescue and fire-fighting services.

Guam tower was evaluated by the FAA in July 1995 and in May 1997. In addition to the FAA evaluations, internal company evaluations are conducted at least bi-annually. These internal evaluations took place during July 1995 and June 1997. Following an internal evaluation, labor hours were increased so as to allow dual coverage of positions during peak traffic periods. Action had been initiated during mid-July 1997 to recruit an additional controller. While on-scene, the Safety Board was advised that although approval from the FAA had not been received, an additional controller was hired on August 12, 1997. The average experience for controllers at the Guam tower is 15 years. Three of the staff, including the manager worked at the same facility when it was a US Navy operation. The full staffing complement is 7 controllers.

The tower is manned 24-hours a day. The facility sits on the south/southwest side of the airport and the positions of operation are arranged in a semi-circular pattern that face generally from the southwest to the northeast. The local control position faces primarily to the west/northwest.[13] There are 4 positions of operation which are: controller-in-charge (CIC), local control (LC), ground control (GC), and flight data (FD). All positions of operation are normally worked combined; however may be split out as traffic conditions and staffing dictate.

The tower is responsible for operations within the Class D airspace, which consists of a 5 nautical mile radius from the center of the Guam International Airport up to, but not including 2,500 feet AGL.[14]

[13] See the tower cab layout which is an attachment to this report.
[14] AGL-above ground level

A. B. Won Pat Guam International Airport

See Operations Group Chairman's Factual Report

Anderson AFB

Anderson Air Force Base has two parallel runways which are oriented the same manner as Guam International Airport. Runway's 6L/6R have 5-step high intensity runway lights (HIRL's); runways 6L/6R/24L/24R have 5-step runway end identifier lights (REIL's); runways 6L/6R/24L have an Air Force Standard Approach Lighting System (ALS); runway 6R has sequenced flashing lights (SFL); runway 6L/24R have visual approach slope indicators (VASI's); runways 6L/6R have precision approach path indicators (PAPI's); and there is an instrument landing system (ILS) approach to runway 6R. With the exception of the PAPI's, all equipment was functional. The policy at Anderson AFB regarding night-time operations is all airport lighting is turned off when there is no pending arriving or departing traffic. This was the case at the time of the accident. The facility did not have any record of ILS navaid outages.

3. Equipment Certifications

A review of FAA Form 6030-1, "Facility Maintenance Log", for the Agana runway 6L glide slope shows that on July 7, 1997, at 2200, an FAA technician coordinated with the control tower to advise that the glide slope was out of service. The record indicates that the glide slope equipment was then dismantled and removed from the building. A review of the Guam FCT FAA Form 7230.4, "Daily Record of Facility Operation", beginning May 1, 1997, up to the day of the accident, indicate that the first entry that the glide slope for runway 6L as being NOTAM'ed out of service, occurred on July 8, 1997, at 2200.[15] This entry was carried forward and was current at the time of the accident. A NOTAM issued by the FAA indicates that the glideslope was to be out of service from July 7, 1997 at 2200, until September 12, 1997 at 0900. Further review of these documents indicates that the facility received no reports from pilots of problems with any navigation or ILS components.

After the accident, the FAA conducted certifications on the following equipment: CERAP: airport surveillance radar (ASR-8) system and air traffic control beacon interrogator (ATCBI-4), automated radar terminal system (ARTS-IIA), FPS-93A and ATBI-5 beacon system; remote micro-wave link terminal (RMLT) for both the surveillance and approach control radar systems. TOWER: visual approach slope indicator (VASI) runway 6L; medium intensity approach lighting system with runway alignment indicator lights (MALSR); automatic terminal information service (ATIS) system, voice recorder system (VRS) dictaphone 500; all tower radio receivers and transmitters.

In addition, a flight check of the DME, localizer, outermarker and non-directional beacon was conducted by the FAA.

[15] FAA Order 7210.3 requires that a facility which operates 24-hour a day, close out the daily log at midnight. Therefore the maintenance log would indicate July 7 and the notification time in UTC and the tower log would have indicated the calendar day of July 8.

A review of FAA Form 7230.4, "Daily Record of Facility Operation for the Guam CERAP for August 5 and 6, 1997 showed the following entries and carryovers:

August 5, 1997

2315 - en route radar out for maintenance, maintenance control center notified, regional duty officer notified (JJ), all other facilities notified.

0215 - QLA & QLB [weather processing channels on the long range radar system] returned to service, FPS93A [equipment nomenclature for the long range radar system] still out for testing, all concerned notified, JJ, regional duty officer, LA, maintenance control center.

0600 - DR on, watch checklist complete, radar system performance check as noted, STU-3 secure [secure message terminal for classified military information].

1100 - QLA AND QLB [weather processing channels on the long range radar system] out of service. Maintenance control center notified (Larry) sensor QLA has some anomolus (sp) weather depictions.

1359 - close of business [log is closed out]

August 6, 1997

1400 - RS on. STU-3 secure [secure message terminal for classified military information], watch checklist complete. Carryover: FPS blanked [military primary radar out of service] 000-080 [quadrant], FPS93A [long range radar system] QLA and QLB weather processing out of service, radar system performance check normal except as noted.

A review of tower and CERAP daily logs from May 8, 1997 until the day of the accident, did not reveal any pilot reports of navigational or landing system anomalies reported to either ATC facility.

A review of NOTAMS[16] for Guam indicated the following:

200613 = runway 6R closed for Boeing 747 aircraft landing and takeoff only. All others remain the same. Effective immediately until further notice (issued on the 20th of an undetermined month)

271544 = unlighted antenna five miles south of the airport 312' AGL effective immediately until further notice (issued on the 27th of an undetermined month)

070213 = ILS glide path for runway 6L out of service from 97072200 until 9709120900 (scheduled outage)

[16] International NOTAM codes are found in FAA Order 7930.2F, FAA Order 7340.1R, the ICAO Aeronautical Information Services Manual or Jeppesen NOTAM codes

250055 = UHF frequency 279.5 out of service effective immediately until further notice (issued on the 25th of an undetermined month)

280324 = Runway 6L and 24R closed from 2200 until 0400 UTC Monday through Friday effective immediately until 9708080400 (issued on the 28th of an undetermined month)

052101 = UNZ VORTAC unserviceable effective immediately until further notice (issued on the 05th of an undetermined month…it is believed this was issued after the time of the accident)

061734 = ILS runway 6L approach plate remarks, delete note "DME REQUIRED" and add note "RADAR REQUIRED". Change missed approach procedures to read: "CLIMB TO 2600, THEN TURN RIGHT HEADING 180 FOR RADAR VECTORS". (issued on the 06th of an undetermined month…it is believed this was issued after the time of the accident)

4. Monitoring of FAA Navigational Aid Facilities

The VOR, TACAN and DME are continuously self-monitored to insure its fail-safe operation. The facility's monitoring system samples radiated signals to determine if the facility's operating parameters are at the established standard or within the prescribed tolerance. If any executive parameter exceeds the standard or prescribed tolerance, the monitoring system will initiate an equipment transfer or shutdown. This insures that the facility will not operate in an unsafe condition. The outer marker is not monitored and receives periodic checks by FAA technicians[17].

VOR monitoring

The function of the VOR monitor in the overall VORTAC system is to monitor the transmitted VOR signal and control the VOR transmitter. The VOR signal is sampled by one of the 16 monitor antennas in the ground check antenna array. The signal sample is detected and processed in the ground check equipment and then routed to the VOR monitor. The monitor and the ground check equipment work together to determine that the VOR transmitter is working properly. If the transmitter is not operating correctly, the monitor will shut down the transmitter and operation of the VOR will stop.

The main task of the VOR monitor is executive monitoring. The primary functions of executive monitoring are monitoring of the transmitted VOR signal and control of the VOR transmitter. The VOR is never without executive monitoring for more than one second.

Six parameters of the VOR signal are monitored during executive monitoring. The six parameters are (1) azimuth angle, (2) 30 Hz modulation, (3) 9960 Hz modulation, (4) field intensity, (5) 9960 Hz deviation, and (6) identification code. If any of these parameters exceed their tolerance values, the VOR transmitter will shut down.

The VOR monitor assembly is redundant. It contains 2 identical and independent monitors. Each monitor is microprocessor controlled. Either monitor can fail without taking the VOR transmitter off the air and without destroying the fail-safe characteristics of the VOR monitor.

[17] See Status Report on the outer marker, dated 1-23-98.

If both monitors are functional, both monitors must detect an out-of-tolerance condition for a prescribed length of time before the VOR transmitter is shut down. If the monitors disagree, the FCPU runs an integrity test on the non-alarming monitor. If the non-alarming monitor fails the integrity test, the VOR transmitter will shut down.

TACAN Monitoring

The TACAN is equipped with 2 simultaneously operating monitors. Each monitor is fully capable of performing all monitor, control, and communication functions. One monitor is designated as the controller and the other is redundant. The controlling monitor establishes system operational parameters. The redundant monitor performs normal monitoring functions but has no control functions.

Both monitors generate interrogations that simulate aircraft interrogations. The interrogations are processed by the transponder and re-radiated. The monitor receives and processes these signals to determine if any out-of-tolerance condition exists.

` The monitor performs the following functions:

1. Quantitative Analysis - measures operational parameters and compares them to system standards and tolerance.

2. Analytical Analysis - determines if out-of-tolerance conditions exist and selects between alternate actions to correct out-of-tolerance conditions or shut down of non-correctable faults.

3. Communication - monitor-to-monitor communication as well as monitor to Facility Central Processing Unit (FCPU), FCPU to monitor, and monitor to transponder communication is performed by the controlling monitor.

4. Interfacing - in addition to the monitor's communication functions, the monitor interfaces the outside world via the Input Output Terminal (IOT) and FCPU to the TACAN equipment.

5. RF Interrogation Generator - simulates aircraft interrogations of the TACAN. This is needed to make a qualitative analysis of overall system reliability.

6. Fault Isolation - performs automatic and user requested fault analysis of the monitor and transponder.

7. Self Test - automatically tests the monitor for reliability.

8. BITE (built in test equipment) Test - test and calibration signals are supplied by the Central Processing Unit (CPU) to verify the accuracy of the monitor and transponder test equipment.

9. Control - establish, on initialization, system parameters such as reply delay, power out, etc.

10. Analog to Digital Conversion - converts system analog signals such as detected RF, power supply voltages, and azimuth test signals into digital words for analysis by the CPU.

11. Antenna Control - switches between TACAN and DME antenna as a function of the mode of operation that the system is in.

The executive parameters are the established limits, which when exceeded, will cause the TACAN to shut down. These parameters are (1) reply delay, (2) pulse spacing, (3) reply efficiency, (4) squitter, (5) power output, (6) radiated power, (7) identification code, (8) 15 Hz azimuth angle, (9) 135 Hz azimuth angle, (10) north count, (11) north duration, (12) auxiliary count, (13) auxiliary duration, (14) auxiliary groups, and (15) rotation period.

5. Weather

A review of the automatic terminal information service (ATIS) broadcast during the time of the accident indicated the following:

"Agana tower information uniform time one four five five zulu wind calm visibility seven one thousand six hundred scattered two thousand five hundred scattered temperature two seven dewpoint two four altimeter two niner eight six runway six in use notams runway six left I-L-S glideslope out of service until further notice advise on initial contact you have information uniform"

A review of the post-accident ATIS indicated the following:

"Agana tower information victor time one six zero four zulu wind variable at four knots visibility five miles light rain few clouds at the surface few clouds one thousand seven hundred ceiling four thousand broken seven thousand five hundred overcast temperature two six dewpoint two five altimeter two niner eight five runway six in use notams runway six left I-L-S glideslope out of service advise on initial contact you have information victor"

A review of the surface weather observations from the National Weather Service on Guam indicated that 5 special weather observations and 1 hourly weather observation were never recorded on the ATIS.[18]

6. Controller Information

Kurt J. Mayo

CERAP radar controller

Entered on duty FAA May 30, 1982

[18] Special observations issued at 0132 and 0147 local time, an hourly observation at 0150 local time, and two special observations issued at 0156 and 0200 local time.

Entered on duty Guam CERAP	September 3, 1995
CTO number	301624203
Facility rated:	December 12, 1995
Micro-EARTS certification	January 8, 1997
OJTI rating:	December 28, 1995
CIC course	April 17, 1996
Last tape talk:	January 30, 1997

Proficiency training

ARTS IIA Update version A2.08	April 10, 1996
Daily Facility Log Carryovers	May 2, 1996
Safety Alert	June 18, 1996
Micro-EARTS Training	January 30, 1997
Use of Micro-EARTS	February 28, 1997
Micro-EARTS Update	February 28, 1997
Micro-EARTS enhancement	March 29, 1997
Micro-EARTS Information	March 29, 1997
Notification of Emergency Personnel	April 28, 1997
Refresher Training - FAA Order 7110.75, paragraphs 2-1-6, 2-1-21, and 5-1-8	June 3, 1997
MSAW Aural Alarm Test/Inspection Procedures	June 24, 1997
Change to ZUA Watch Checklist(MSAW Alarm Procedures)	June 29, 1997
Refresher Training - FAA Order 7110.65 paragraphs 2-1-6, 5-15-7	June 30, 1997
July Refresher Unit - Lost communications emergency order	July 9, 1997
Review of Approach Clearance Procedures	August 28, 1997

Marty I. Theobald	Local Controller
Initial Hire date Agana FCT:	May 15, 1995
CTO Number:	350443367
Visibility certificate:	May 9, 1997
FD/GC authorized hours/actual certification hours	32---24
LC authorized hours/actual certification hours	72---30
CIC course	July 3, 1995
Last tape talk:	March 25, 1997
<u>proficiency training</u>	
Notification of emergency personnel	February 27, 1997
Emergencies	May 20, 1997

7. Interview Summaries

Marty Irvin Theobald Local Controller - Agana Tower

On August 8, 1997, the ATC Group interviewed Mr. Theobald. In response to questions, he provided the following information:

His date of birth is December 6, 1957. He was hired by Barton Air Traffic Control Services as an air traffic controller at the Agana, Guam Federal Control Tower. He is fully certified on all positions of operation in the tower which are: clearance delivery, ground control, local control and controller-in-charge. His operating initials are TO. He is medically qualified as an air traffic controller and had in his possession a Class II medical certificate without waivers or limitations. His last physical was on April 9, 1997. He also had in his possession CTO number 350443367 issued on May 24, 1995. His immediate supervisor is Ms. Sherrie Ewert, the facility air traffic manager. She has been his immediate supervisor since January or February 1996. He started in air traffic control in the United States Navy. He went to initial Navy training in 1983 and was later assigned to NAS Chase Field, Texas. He worked in terminal radar approach control (TRACON), radar approach control (RAPCON) radar final, arrival radar, departure radar, precision and surveillance radar. While in the Navy, he was assigned to NAS Agana during May 1989. He was qualified in all tower positions and also worked in flight planning, and as a radar final controller, tower supervisor, facility watch supervisor, and for about 6 months was radar branch chief. He supervised 9 to 12 controllers as a supervisor. In February 1992 he served as an air traffic control administrative assistant and was discharged from the Navy during October 1992. He remained on the island and worked as a mechanic until he was hired by Barton.

He said that he had worked in the same control tower when it was under the control of the Navy. At that time there was a non-certified BRANDS radar display in the tower and that it was not

certified for separation of aircraft. It did display secondary and primary radar targets. The secondary targets were generated by a TPX-42 radar system. The BRANDS, as well as other Navy equipment was still in the tower when he was hired by Barton. The BRANDS was later removed and a D-BRITE radar display was installed.[19] He could not recall the exact time frame except to say there was a period when there was no radar display in the tower cab.

On Monday, August 4, he had worked a 2245 to 0700 shift. After getting off work, he went home and got his children off to school and his wife off to work. He then went to bed. He did not eat anything that morning. He went to bed between 0725-0730 and woke up about 1330. He then ate breakfast. He watched television until 1800 and believed that he had eaten dinner between 1800 - 1930. He then stayed around the house until 2030 and went to the airport to pickup his daughter. He did not have a heavy evening meal. He did not consume any alcoholic beverage that day. He did not take any type of prescription medications and thought that he might have taken a couple of Tums. He noted that he also takes vitamin C, but only if he remembers to take them. He was not sure if he had taken any that day. After picking up his daughter he took her and his wife back home and left the house about 2200 and came to work. The drive to the airport is about 3 miles. He did not bring any coffee, snacks, or a lunch with him. He noted that there is a coffee pot in the tower. He arrived at the tower about 2215.

After arriving at the facility he made a pot of coffee and then did a position relief briefing with the controller on duty. The briefing covered airport conditions, navaid conditions, traffic clearances issued, equipment status. A checklist was used and it is located under the Plexiglas on a tower console. After midnight, he did the traffic count and started a new watch log. He stated that the glideslope was NOTAMed out of service and had been since he had returned to the island from vacation on July 22. Everything else was operational. He said that although the D-BRITE was working it was not a certified display. There were 2 new display panels and 2 control panels installed in the tower while he had been away on vacation. He had never received any certification training on the equipment. And he also noted that the control panels were not connected to the best of his knowledge. He said that the video map is not that of the airport but rather to Anderson field. While the display will show secondary radar targets it is dependent upon what the tower controllers at Anderson field have selected as to whether mode C targets will be depicted. He said that the controllers are not able to correlate their airport because there are no final approach courses depicted and that the airport is shown as a circle on the video map.

He said that the local control position at which he was working is located in the center of the tower cab, facing the runway. He said that from the time the inbound on KAL801 was given, until the time he initiated the search for the airplane, he was both sitting and standing in the tower cab. He said that the runway lights for 6L were on step 2; the lights for 6R were on step 3; and the medium intensity approach lights (MALS) were on step 1; and that the REIL was on (MALSR). None of these settings were changed until after the accident when a Ryan flight requested that the lights on runway 24R be changed from step 2 to step 3. He then documented the runway light settings about an hour after the Ryan flight had landed. He said that no one else had touched the runway lighting panel during that period. He said that when KAL801 made initial radio contact that was the only airplane that he had to work and that there were no ground movements being conducted. He said that there were no push-backs being conducted; however, he noted that the tower does not issue push-back or engine start clearances because they are given by the ramp control.

[19] The D-BRITE was installed on January 16, 1997. According to SERCO, the tower manager was never notified by FAA Airway Facilities technicians that the system was certified for use. In July 1997, different monitors and associated hardware were installed.

He said that when the inbound was given it was not raining at the airport, but he did note that it had rained earlier and that the runways were starting to dry. He estimated the visibility to be 7 miles and that it was a moonless night. There were no visible low lying clouds and he believes that ground light sources would have been enabled him to determine their presence. He did not observe any lightning in any quadrants around the airport. He said that there was a shower that was "pushing" in from the northeast over the airport and that it was moving right down the runway to the southwest. He was not exactly sure when it started raining on the airport because he was using the tower binoculars to see if he could observe the Korean 747. He did not look at the D-BRITE to determine if any weather was being displayed. He went on to note that he did not know if the system had the capability of displaying weather.

He said that the ridge line (Nimitz) is not visible at night. He said there is a light up there, but that it is not always working. There are no lights beyond the ridge. He said that it is about 4.5 miles from the ridge to the airport. He could see the lights from the Navy hospital which he believed was about 3 7/8 or 4 miles away and was located in a quadrant toward the ridge line. He said there was a period when he could not see the hospital because of a shower that was moving through the area. After issuing the landing clearance to KAL801, he scanned to the southwest looking for the airplane but did not observe it. When asked why that might have occurred, he said that at times, aircraft might not be visible given their angle to the final approach course. He said that the letter of agreement between the tower and the CERAP does not define a transfer of control point (TCP). He went on to say that an airplane would call the tower dependent upon the type of approach they are executing. He had not listened to the recorded voice communications since the morning after the time of the accident.

When asked why he had told the approach controller, "I cleared him to land told him not in sight", he said that he may or may not have told that to the flightcrew and that he was not sure. When asked if he were required to advise an aircraft when it is not in sight, he replied, only if the airplane is not in a position where you should have him in sight and then such an advisory would be issued. He became concerned when he realized that the airplane had not reached a point at where he should have been able to see him. He then made a radio call to the airplane. This occurred after he had issued the initial landing clearance. He said that his awareness of an airplane's position is not based so much on a sense of timing as it is a perception. When asked if what he was referring to might be called a gut feeling, he replied, basically yes. He said that he might have glanced at the D-BRITE to see if the airplane was being displayed, but he was more concerned with seeing the airplane visually. When asked if he had observed anything in the southwest quadrant that he would equate to an explosion or unusual circumstance, he said no. When asked if he had ever had the experience of a commercial aircraft landing at an airport other than Agana airport, he replied, not personally. When asked if he had encountered any problems with Korean Air flightcrews, he replied, that communications difficulties might have been experienced, but that it was not just confined to Korean Air flightcrews but other users as well. He went on to note that communications difficulties were not associated with any particular airline.

He said that he believed that the airport should have been visible to the flightcrew and that they should have been able to see the airport in the "neighborhood" of 5 miles. When he became concerned, he attempted to call the flight because he did not see them. In his professional experience, he believed that the airplane should have been visible at 4 to 5 miles, and he also stated, "that's only a guess though". He said that during the period that the glideslope has been Notamed out of service, he received no reports from other aircraft of erroneous readings on any component of the instrument landing system, the glide slope, or any other navaids. When asked if such reports would be given to him by pilots, he replied, yes that he believed that such reports

would be given to the tower. To his knowledge there were no reports of any malfunctions reported to any controller of navaid or glideslope components prior to the time of the accident. He said that he had heard reports about problems with the outer marker but this was only hearsay.

When asked if he felt fatigued during the course of the shift, he replied, not at all. When asked if he might have taken any catnaps during the course of the shift while on duty, he said no. There were no distractions in the tower cab which took him away from his duties, other than a period when he attempted to make a new ATIS broadcast and he never got it completed because he received a clearance call from the CERAP. During the period that KAL801 was inbound to the airport he was standing.

With regard to the runway lights, he noted that daily checks of the runway lights and MALSR are conducted. He said the runway lights are checked by an airport electrician and that the operation of the MALSR is confirmed by requesting a report from the first landing aircraft after sunset. He also stated that the operation of the runway lights can be confirmed by visual observation from the tower. He said that the procedure to request confirmation of the MALSR is a practice within the facility to conduct a daily check of this equipment. He noted that it is a checklist item and is noted on the checklist located under the Plexiglas. He went on to explain that if there are no problems, there will be no entry into the daily log; however, if a problem is noted, it is put into the log. When asked if he and the controller he had relieved had discussed the operation of the runway lights and MALSR, he replied that there had been because they had discussed whether a check mark or the date was to be used on the equipment checklist.

He began to become concerned about KAL801 when he attempted to call the flightcrew and got no response. He then was involved with some minor coordination with ramp control. He attempted again to call the flightcrew and then called ramp control. He also called the CERAP and Anderson tower. He observed the lights of an aircraft to the south or southeast and asked the CERAP if that was KAL801. He was told it was an inbound Ryan flight. He then asked the CERAP controller to check for the airplane. He knew that an accident had occurred as soon as he was told that the Ryan aircraft saw a fire. He then notified the airport authority through ramp control and also advised them to tell the airport manager. He then activated the crash phone.

In response to other questions, when asked about the type of aircraft, he said that KAL801 is normally an Airbus and that it was shown on the inbound flight strip. He then marked the flight strip to note the change in aircraft type. He went on to say that the airport authority provides the facility with a monthly operational schedule. When asked if everything seemed normal while talking to KAL801, he said that it did. When asked if he knew any reason why a pilot might believe that the glide slope was operational, he replied, none whatsoever. When asked if an aircraft, near the outer marker, on a normal night approach, was visible from the tower, he said ordinarily. When asked if the same aircraft were low by 200 to 300 feet would he remain visible from the tower, he replied that he did not know. When asked if it was true that the D-BRITE was not commissioned and that he had not received training on it, he replied that's right. When asked if the D-BRITE was an operational tool, he replied, not at this time.

He said that he has never been involved in an aircraft accident during his entire air traffic control career. He stated that his eyesight is 20/20, but that he could not determine the distance of an airborne object at night without the benefit of ground reference. When asked if he could normally observe an airplane about 4 miles from the airport, he said that it was dependent upon ambient conditions and lighting. He said that there is a street light, located on a hill about 4 to 5 miles from the tower. He said that he would be able to tell if it were raining outside of the tower as

a result of seeing the rain on the windows. He then explained that weather observations are received from the National Weather Service and put on the ATIS broadcast. After the new broadcast has been made a blanket broadcast is made to advise that a new ATIS is in effect. He then explained his work schedule which is a midnight shift from 2345 to 0700; 3 evening watches from 1500 to 2300 and one day watch from 1100 to 1800. He said that if he observed a aircraft making an abnormal approach, he would advise the flightcrew. He said that he has never had to advise a flightcrew of such.

He said that there was only one controller in the tower cab at the time of the accident. He said that the lavatory is located one floor below the tower cab. He said that if he becomes ill while on duty, he is expected to call the air traffic manager. He said that he did not know exactly how far from the tower she lives, but believed it was several miles north. He stated that he did not feel ill on the night of the accident. The runway lights are turned on at sunset. There is no requirement to turn the runway lights off at night. He said that he had heard rumors about the outer marker several days after the accident. The outer marker is not monitored by the tower, but the glideslope and localizer are, and there were no localizer alarms on the night of the accident. There are 6 controllers, including the air traffic manager. One of these controllers is currently in training.

Kurt James Mayo CERAP radar controller

On August 10, 1997, the ATC Group interviewed Mr. Mayo. In response to questions, he provided the following information:

His date of birth is December 30, 1957. He was hired by the FAA and began duties as a controller at the Los Angeles Terminal Radar Approach Control (TRACON) where he progressed to a full performance level (FPL) controller. The facility was moved to the Southern California TRACON on February 12, 1994. He transferred to the Guam CERAP on September 3, 1995, where he is currently a FPL controller. His operating initials are KM. His immediate supervisor for about the past 4 months has been George Foster. He has previous ATC experience which was gained while serving with the United States Navy. His last duty station was Cubi Point, Philippines where he worked from 1978 to 1982. He was rated in both radar and tower operations. He is not a pilot. He is medically certified as a controller without waivers or limitations.

On Monday, August 4, he had worked a 1600 to 0000 (local) shift and then worked the 0000 to 0800 (local) shift that night. The midnight shift on August 5 was the fourth day of a 5 day workweek. After he got off work on August 5 at 1600 he went to the commissary and shopped for about 10 minutes. He then drove home which took about 20 minutes. He went to dinner at the Hilton Hotel about 1800. The dinner took about 1 hour. He then returned home and slept from 1930 to 2230. At 2310 he left the house to take his roommate and girlfriend to the airport. He then drove to work and arrived at the facility about 2345. He described his meal as not being heavy or light, but rather as medium. He was not taking any type of prescription or non-prescription medications. He does not drink alcoholic beverages. He does take a multi-vitamin in the morning and one in the evening. He said that he slept soundly and that when he awoke, he felt rested. His work schedule for the past 2 days was not a normal working schedule, but rather one that had occurred as a result of him trading shifts with another controller. It was something that he chose to do.

After arriving at the facility, he relieved the controller at the R-4/D-3 positions. His co-worker arrived as he was relieving the controller. His co-worker assumed the duties of controller-in-charge

(CIC) and at midnight, this controller assumed duties at the D-3 position. While at the R-4 position, he was responsible for all en route and approach control positions. At the time of the suspected airplane accident, his co-worker had left the radar room on a break and was not present. At 0110 (local) he assumed the duties of the D-3 position and the position log was changed to indicate that he was assuming those duties as well. The approach control radar display was set to a 60 nautical mile radius. The en route display was set to 265 miles although it normally covers 250 nautical miles. The long range radar map was centered. The approach control radar map was slightly off-set to the south because most traffic departs to the north. This traffic flow does not occur only on the midnight shift, but rather throughout the course of a day.

The en route radar display was set up as follows: the arrival/departure tab list was set in the upper right hand corner of the display; the coast suspend list was set in the lower right hand corner of the display; the MSAW area was set in the lower right hand corner; the system area was set in the upper left hand corner and the preview area was set in the lower left hand corner of the radar display. The en route radar system was displaying secondary radar target information only. It was that way when he relieved the controller on duty and remained that way for the entire shift. The Airport Surveillance Radar (ASR) -8 settings were as follows: The systems area was in the lower center of the display; the tab list was in the lower left corner; the coast suspend list was in the right center; the preview area was in the lower left corner, above the tab list; and the MSAW area was in the lower center of the radar display. This system was displaying both primary and secondary targets. He stated that the en route radar system was not able to display weather information; however, the approach control radar was displaying weather and he noted that weather was moving throughout the area the entire shift.

The last time that he had listened to the recorded voice communications was on August 6 at 0700. After the accident, he reviewed the Air Traffic Control Handbook. When asked specifically what he had reviewed, he said that he had reviewed that portion relating to the required phraseology when issuing an approach clearance and radar service termination. He reviewed this information on his own accord and was not told by anyone to do so. When asked what had prompted the review, he said it resulted from questions that he had about the approach, the service that had been provided and responsibilities. When asked what type of responsibilities he was referring to, he said his responsibility for providing radar service throughout the approach.

When asked to describe his traffic complexity and density from the time of initial radio contact with KAL801 until he advised the flightcrew to contact the tower, he said it was light to moderate traffic and routine complexity. During this period he believed that he might have been working 10 to 15 aircraft, inclusive of KAL801. When asked how he was aware of weather in the area is he did not have the capability to display it on the en route radar system, he said that he knew of its presence because the flightcrew of KAL801 said something about “CB” during their second deviation and during the course of the shift there had been other deviations as well. When asked how an approach procedure for an aircraft is determined, he said that it is basically a joint decision between the pilot and the controller and that should weather dictate, he is required to provide an instrument approach procedure. When asked about the decision to provide an ILS approach to runway 6L to KAL801, he said it was based on an earlier arrival from Saipan (CMI960 @ 1508) that had come into the area from the northeast and could not see the airport until 7 miles north at an altitude between 2,600 and 2,000 feet. Based on the fact of past practice in that Continental Micronesia is a regular user and local company, he would assume that their flightcrews would be more familiar with the area than other flightcrews. He went on to say that while this flight was at 2,600 they had requested a descent to 2,000 feet and finally saw the airport while on

downwind on the west side of the airport. He also based his decision on the ILS to runway 6L based on his knowledge that more than 90% of Korean Air flightcrew's request the ILS approach.

When asked what the term "glideslope unusable" meant to him, he said it meant that the flightcrew would only have the localizer available and would have to use step-down altitudes rather than have use of a glideslope during the approach. He did recall advising the flightcrew of KAL801 of the ATIS code and that he had received their acknowledgment. He went on to say that when the approach clearance was issued they did not readback the term "glideslope unusable" or anything to that effect. When asked if he is required to receive a specific acknowledgment of "glideslope unusable", he replied, not to my knowledge. When asked if he was required to receive acknowledgment for an approach clearance, he said yes. When asked what his understanding of the term, "checking uniform" meant, he said that it meant to him that the flightcrew was in the process of checking it (ATIS) or that some flightcrews would use the term checking to mean roger. He said that the use of the term checking is not unique to Guam and that he had heard it used in other air traffic facilities in which he had worked. He equated its use to a flightcrew that spoke English rather than a term used more by foreign flightcrews. In his view, he believed that the flightcrew of KAL801 was telling him that they either had the current ATIS or that they would get it. The facility does not have the ability to monitor the tower ATIS broadcast. He said that the decision to issue an altitude of 2,600 feet was based upon the fact that it is the initial approach altitude for the ILS approach to runway 6L.

He said that he observed on the ASR-8 radar system the target of KAL801 established on a segment of the approach at their assigned altitude. When asked what segment of the approach, he said just inside of the initial approach fix. When asked how far from the outer marker, he replied about 4 to 5 miles from the marker. When asked the airplane's position when he told the flightcrew to contact the tower, he said they were about 2 miles outside of the outer marker. He stated that he did not continue to monitor the progress of the airplane after he instructed the flightcrew to contact the tower. His last observation of the position of the radar target was about 7 miles out from the airport at an altitude of 2,600 feet. When asked if there is a point at which a controller will terminate the radar monitoring of an arrival, he said that there was no set point. When asked what might have precluded him from monitoring the progress of the airplane on final, he said that there were other duties which he was performing which might have precluded him from further monitoring of the flight. When asked if there duties were related to en route or approach services he replied, both.

He said that he did not observe any type of visual MSAW alert on the flight nor did he observe the data block go into coast.[20] When asked if there was any weather depicted on the ASR-8 radar display, he said yes there was. When asked to describe it, he said that it appeared to be of light to moderate intensity and that it was a relatively small cell. He said that while there was a lot of weather in the area, he had received no reports of rain in that particular area. In relation to Nimitz, the cell extended about 3 to 5 miles on the final approach course and was about 2 miles across, possibly 3 miles in the largest area. He did not observe KAL801 enter the cell. When asked if he had any duty or responsibility to advise an aircraft of such a cell, he said no.[21] He went

[20] When a radar target is no longer being tracked or received by the system, the data block will display CST to alert the controller and after a given period of time will be moved into a "coast/suspend" tab list located on the radar display.

[21] It was noted that FAA Order 7110.65, "Air Traffic Control", advises the controller in part to, "Inform any tower for which you provide approach control services if you observe any weather echoes on radar which might affect their operations".

on to say that he has no way of knowing the intensity of such a cell because all information is displayed in the same manner and has no color. When asked how he had determined the intensity, he said the level of opaque shading and his experience as a controller is how he was able to judge the intensity level.

He said that when the tower called him to inquire about KAL801, he was working about 5 other aircraft. When asked to provide his actions after the call from the tower, he said that he scanned the radar display thinking that the airplane might have executed a missed approach. In his mind, the airplane could only be in 3 places given the time which had elapsed. It should have been displayed on the radar, or it should have been on the runway, or it had crashed. When asked why he had made a statement about the airplane crashing west of the airport, he said it was because the airplane had approached from the west.

He said that about 0153 he asked for assistance from an automation specialist that he knew was in the building. He recalled yelling something to the effect of, "Richard we've had a crash or we've had an accident". When asked if the facility has the capability to monitor the VOR, he said yes. When asked if it will provide an alarm should it malfunction, he said yes, both an aural and visual alarm. When asked if he had observed or heard any alarms from the time that the tower had called him to inquire about the flight, upon when search and rescue efforts were started, he said no. He said that he was certain there had been an accident after querying a Ryan flight that was inbound from the south. After the crew's comment about the sky or clouds lighting up, he was just about certain that an accident had occurred. He then asked the Ryan flightcrew to look for signs of a crash and their reported observations confirmed it.

In response to other questions, when asked if he was confident that his equipment was working properly that morning, he said yes, that he had no reason to believe that the radar target was not where it should be. When asked if in his past experience as a controller, he expected pilots to familiarize themselves with NOTAMs concerning outages, he replied absolutely. When asked if he believed that the flightcrew of KAL801 understood that the glideslope was out of service, he said that he had asked earlier in the week that this information were routinely being broadcast on the ATIS and had been told that it was. When asked if it were common to receive MSAW alerts on aircraft in the vicinity of Nimitz, he said no.

He said that he was the only controller in the radar room at the time of the crash and that the other controller was upstairs in the break room. He felt fit and very alert during the shift. He was aware that there is a D-BRITE radar display in the control tower, but he did not know one way or the other if it was working. The range on the ASR-8 was set to a range of 60 miles. He said that there is an intercom system between the radar room and the break room. When asked if he knew why the airplane had crashed, he said that he did not want to speculate. When asked if he had ever received a visual and aural MSAW alert on previous occasions, he replied yes. These had occurred when he was working both en route and approach control radar systems. He stated that the facility has the ability to see aircraft all the way down to the runway and that it will display aircraft at an altitude of 600 feet which is the field elevation. He said that continued monitoring on radar after transfer to tower is based on the workload and a controller's preference in that some controllers may be more observant and others less observant. When asked if he knew what the filter limits of the ASR-8 radar were set to, he said that when he relieved the controller on duty he did not change them and he did not know what they had been set to. When asked what the prescribed elements of an approach clearance were, he stated, position from a fix, an altitude to maintain until established, and the approach clearance. He further stated that in the case of KAL801, that he also had to state the equipment problem. He noted that KAL801 was not on a

vector and that he did not issue an altitude to maintain because he observed that the airplane was already established and at the assigned altitude of 2,600 feet . As a final note, he said that he never received an aural MSAW alert for KAL801.

8. Other Pertinent Information

On August 9, 1997, the ATC Group conducted an informal interview with the Air Traffic Manager of the Agana tower. In response to questions, she provided the following information:

Sherie L. Ewert

Ms. Ewert first provided an overview of the issues surrounding the BRANDS and D-BRITE radar displays at Agana Tower. The U.S. Navy-owned BRANDS display system was removed from Agana Tower by maintenance personnel contract by the Navy. The FAA installed the current CONRAC D-BRITE monitors. Ms. Ewert believed that the U.S. Air Force at Anderson AFB had previously made a verbal agreement to negotiate a Letter of Agreement between Anderson AFB and Agana Tower regarding the video map setup and usage of the Agana Tower D-BRITE displays. This would be necessitated by the fact that the associated control panels for configuring the Agana Tower D-BRITE maps and settings are currently located at Anderson AFB Tower. This verbal agreement took place sometime prior to Ms. Ewert's tenure as Manager of Agana Tower, and before the FAA CONRAC D-BRITE displays were installed. At some point afterwards, Anderson AFB staff, while acknowledging they had earlier agreed to a Letter of Agreement, now declined to do so. The stated reason was to the effect that they (the USAF at Anderson AFB) did not want to have to tell their controllers specifically how to set up their displays.

Afterwards, Ms. Ewert expressed her dissatisfaction with the situation to a number of FAA management personnel. Her primary point of contact was through Guam CERAP. All of her communications on the subject were verbal and none were in writing. She could not recall the specific response she received from the Guam CERAP personnel, but said that "they seemed to understand (the problem with the D-BRITEs)". Lloyd Golden, a former FAA official, and now an equipment contractor to FAA, was another point of contact for Ms. Ewert. Ms. Ewert expressed her concerns to a variety of FAA officials who have visited Guam during her two-year tenure as Agana Tower Manager, and attempted to determine appropriate points of contact for further action. This included a group of FAA and contractor officials who visited Agana Tower in September, 1996. The purpose of the FAA-sponsored visit was to inspect Agana Tower's facilities for the purpose of deciding whether a new tower would be commissioned, or if the existing facilities would be upgraded. The FAA eventually decided not to build a new tower. Ms. Ewert believed that the FAA planned to eventually give Agana Tower control of the installed D-BRITE displays. She had not received any dates as to when Agana ATC personnel might expect to receive training on the D-BRITE system. This might result from the fact that some equipment required for D-BRITE operation was not installed.

The mapping changes required for Agana Tower to use the D-BRITE displays had been discussed with FAA, and she had worked on the actual specifications with Guam CERAP Automation Specialist Richard Paolillo. She did not know if the mapping project had ever been sent out (from Guam CERAP to the necessary FAA offices for approval and programming). It was Ms. Ewert's understanding that FAA Air Traffic personnel would train Agana Tower's personnel on the D-BRITE system. The only other equipment problems she is aware of at Agana Tower involved occasional pilot complaints regarding insufficient brightness of the Runway 24 VASI. To her

knowledge, all recent complaints occurred during bright sunlight conditions. Subsequent inspections of the VASI system by FAA Airways Facilities technicians always showed it to be operating within specified parameters.

In terms of changes she would like to see at Agana Airport, Ms. Ewert stated that she desires an ILS approach to the 24 runways. During the annual typhoon season, the airport is normally changed to a Runway 24 configuration. The lack of a precision approach to the 24 runways is a problem. She believed that there are currently VOR and NDB approaches to one of the 24 Runways, and that they have a GPS approach being commissioned. There may also be work in progress to consider lowering the approach minimums for the existing NDB approach, which she characterized as "high". She is not aware of any complaints or problems regarding runways 6. Agana Tower occasionally receives advance notice from FAA regarding impending equipment changes on short notice. She believes that Agana Tower received about one month's notice regarding the D-BRITE installation. The installation of the D-BRITE displays had no significant impact on Agana Tower operations. It is normal for Agana Tower controllers to consume food and beverages while on duty in the control cab. Most controllers bring their own lunches. For single-controller mid-shifts (all-night shifts), which are the norm at Agana Tower, physiological (bathroom) breaks are generally accomplished when there is no traffic. The normal procedure is for the Agana Tower controller to advise Guam CERAP and Airport Ramp Control that the tower will be unmanned for a short period. The Agana Tower controller also carries a hand-held transceiver with them until returning to the cab. Upon returning, the controller then advises Guam CERAP and Ramp Control that they are back. The same general procedures are used when it is necessary for tower controllers to step outside on to the external catwalk in order to clean condensation off of the cab windows. However, the controllers normally do not take the handheld radio onto the catwalk, since it could be easily damaged. Cleaning of the external windows typically occurs 2 to 3 times during a mid-shift, depending on the weather.

Ms. Ewert recently received a copy of an FAA plan to renovate Agana Tower's facilities, which is scheduled to commence sometime around January, 1998. She believed it was called the "50% Plan". The plan includes the installation of external tower cab window washing system, and control headset jacks in the cab bathroom. During her two-year tenure as tower manager, annual traffic volume at Agana Airport grew from approximately 42,000 operations (estimated) to approximately 65,000 operations. This is an increase of nearly 50%. She has not discussed forecast traffic growth with FAA. Airport officials expect continued growth of civilian traffic, particularly involving locally-based flying schools. At least three new flying schools have opened since she became manager. She does not believe that anyone at Agana Tower would consider the currently installed D-BRITE displays to be useable, operational tools. She has heard rumors that some controllers may have thought that the ILS Glide Slope was back in service, although the associated NOTAM had not been canceled. She could not recall where she heard this, but it may have been through television media.

She stated again that everyone in the tower understands that the D-BRITE system is not operational. During night IFR conditions, weather determines when a controller would see an approaching aircraft. With 7 miles of prevailing visibility from the tower cab, weather over the Outer Marker area might prevent her from seeing an inbound aircraft at that position. If an approaching aircraft was approximately 200 feet below glide path at the Outer Marker during a night, IFR approach, when visibility should be sufficient to see an aircraft at the proper altitude, it would be hard to determine the relative altitude from the tower. The D-BRITE displays are normally kept on 24 hours a day. Agana Tower does not have a VOR or DME monitoring system. This equipment is

located at Guam CERAP. Agana Tower airspace is categorized as “Class D”, from the surface up to and including 2,500 feet MSL. Agana Tower control services are contracted by the FAA.

9. Air Traffic Control Procedures

Air traffic control procedures are contained in FAA Order 7110.65, “Air Traffic Control” The procedures may be supplemented by local standard operating procedures (SOP).

10. Radar and Minimum Safe Altitude Warning (MSAW) data

The investigation team was provided with recorded radar data derived from the micro- en route automated radar terminal tracking system (E-ARTS). The ARTS IIA which is also used by the facility does not have the capability of recording the radar data. In addition, hard copies of this data, as well as an extraction of minimum safe altitude warning (MSAW) data were provided to the Safety Board. After a review of the computer printout, it was determined that an E-MSAW visual alert was generated and displayed on the en route display. Based on this same review, it was also determined that no aural or visual alert was generated by the ARTS IIA system as the airplane descended below the minimum descent altitude, “outside” of the VOR. As a result, an MSAW warning for the terminal radar system was neither displayed nor heard by the radar controller The Safety Board asked the FAA to provide their software programming data for the MSAW. Following this request, the FAA told Safety Board investigators that a software error existed; however, further investigation determined that the terminal MSAW had been purposely programmed to inhibit all MSAW alerts within a 54 nautical mile radius of the airport. MSAW processing did occur within a 1 nautical mile “band” out to 55 nautical miles from the airport. This change became effective during April 1996. The FAA’s Technical Center, in Atlantic City, New Jersey, is responsible for the development and distribution of all FAA ARTS software. A national programming change was designed to eliminate MSAW “nuisance alerts” which were being generated by aircraft primarily after having been cleared for a visual approach in which the pilot would be responsible for his own terrain clearance. In addition, it was learned that the aural E-MSAW alert had been programmed in such a manner that it was inhibited.

After this discovery, the FAA began a campaign to determine that the MSAW system within 193 air traffic control facilities was programmed correctly. It was reported that of this number, two were not, but were corrected. In addition, Safety Board and FAA staff began a series of meetings which started on August 27, 1997. During September 1997, the FAA provided the Safety Board with an executive summary of their on-going fact finding review of their MSAW program.

11. Recorded Radar Data

Recorded radar data from the Guam CERAP was provided to the Safety Board. This data was used by engineers of the Safety Board’s Vehicle Performance Division to develop radar track plots.